Appendix E Retirement of Capacity

All retiring wind turbines are assumed to be refurbished or replaced immediately, because the site is already developed with transmission access and other wind farm infrastructure. Wind capacity is replaced simply by assuming the wind capacity never decreases, i.e. the turbine capacity lasts indefinitely.[12] This does introduce a small error that is currently ignored. At the time that retiring wind turbines are replaced, they will most likely be replaced by state-of-the-art turbines, which can be expected to produce more energy and power per land area, and have higher capacity factors and lower costs than the machines they replace. This upgrading is not currently accounted for.

Similarly, storage at the wind site is assumed to be replaced immediately upon retirement. On the other hand, grid storage retires automatically when its assumed lifetime has elapsed.

Retirements of conventional generation can be modeled either as a fraction of remaining capacity each period (gas plants), through exogenous specification of planned retirements (currently used for nuclear, hydro, and oil/gas steam plants), or economic retirements (coal plants built before 2006).

Gas-fired Capacity Retirements: Because gas combustion turbines have been—and continue to be—used extensively as peaking plants, gas-CT capacity retirement is assumed to have reached a steady state condition, best modeled by assuming a fixed fraction of existing capacity is retired each year. The fraction retired is set equal to 1/assumed plant operational lifetime.

$$CONVRET_{n,CT} = CONVOLD_{n,CT} \cdot \left(\frac{2}{ltime_{CT}} \right)$$

After 2020, gas combined-cycle power plants are also retired at the fractional rate of 1/assumed plant operation lifetime. However, because such a high fraction of these plants were built in the four years between 2000 and 2004, the annual retirements before 2020 are restricted to 1/20 of the capacity that existed before 2006.

Nuclear, hydroelectricity, and oil/gas steam turbines: In reality, the retirement of these plants is determined by a host of factors other than their operational viability and economics. Thus, in ReEDS, where it is known that plants are scheduled to retire, that schedule is used. All capacity that does not have a scheduled retirement date is assumed to retire at a rate of 1/assumed plant operational lifetime.

$$CONVRET_{n,q} = PRETIRE_{n,q} + (CONVOLD_{n,q} - REMSCHED_{n,q}) \cdot \left(\frac{2}{ltime_q} \right)$$

Coal-fired capacity retirements: Existing coal plants are retired based on both their assumed operational lifetimes and their variable operating costs relative to the costs of constructing and operating new gas combined-cycle plants.

$$CONVRET_{n,q} = CONVOLD_{n,q} \cdot \left(\frac{2}{ltime_q} \right) \left(1 + \frac{CONRETkn\_pgas_n}{VCcoal_{n,q}} \right)^{-3}$$

New coal plants are assumed to last beyond 2050, so there are no retirements of these plants.

[12] In deciding whether to invest in wind, the model uses a 20-year evaluation period, i.e. the turbines are not assumed to last indefinitely.